

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number:

0 392 750 B1

(12)

EUROPEAN PATENT SPECIFICATION

(43) Date of publication of patent specification: **25.01.95** (51) Int. Cl.⁸: **A61B 17/068**

(21) Application number: **90303694.5**

(22) Date of filing: **06.04.90**

(54) **Fascla stapler.**

(30) Priority: **10.04.89 US 335822**

(43) Date of publication of application:
17.10.90 Bulletin 90/42

(45) Publication of the grant of the patent:
25.01.95 Bulletin 95/04

(64) Designated Contracting States:
DE FR GB

(56) References cited:
EP-A- 0 129 442
FR-A- 2 443 238
US-A- 3 831 608
US-A- 4 724 840

(73) Proprietor: **United States Surgical Corporation**
150 Glover Avenue
Norwalk,
Connecticut 06856 (US)

(72) Inventor: **Green, David T.**
28 Bermuda Road
Westport, CT 06880 (US)
Inventor: **Young, Wayne P.**
Allview Avenue
Brewster, NY 10509 (US)

Inventor: **Bolanos, Henry**
54 Myrtle Street
East Norwalk, CT 06855 (US)
Inventor: **Gelste, Robert J.**
44 Overlook Drive
Millford, CT 06460 (US)
Inventor: **Ratcliff, Keith**
36 Toddy Hill Road
Sandy Hook, CT 06482 (US)
Inventor: **Alesi, Daniel E.**
48 Possum Drive
New Fairfield, CT 06812 (US)

(74) Representative: **Marsh, Roy David et al**
Hoffmann Eitle & Partner
Patent- und Rechtsanwälte
Postfach 81 04 20
D-81904 München (DE)

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

Descripti n

This invention relates to a fascia stapler. More particularly, this invention relates to a fascia stapler for stapling an incision.

Heretofore, various types of staplers have been used for the stapling of tissue and, particularly, the closing of incisions in the tissue. Generally, these staplers have been constructed so as to eject a generally U-shaped staple into the tissue transverse to the incision while at the same time bending the staple legs towards each other so as to maintain the incision in a closed state. Fascia tissue, however, is relatively thick and not easily manipulated for suturing using conventional stapling techniques.

Accordingly, it is an object of the invention to provide a relatively simple stapler for the stapling of fascia tissue.

It is another object of the invention to provide a stapler capable of rapidly closing an incision in fascia tissue.

It is another object of the invention to provide a fascia stapler which is capable of suturing fascia tissue using fascia staples of two-piece construction.

Briefly, the invention provides a fascia stapler for stapling an incision which includes an anvil which can be inserted under the fascia tissue, a retainer cartridge housing a plurality of elongated retainers and having means for sequentially discharging a foremost retainer, a strap cartridge having a plurality of elongated straps and means for positioning a foremost strap in alignment with one end of the discharged retainer and means for expelling the foremost strap from the strap cartridge in a direction towards the anvil for penetration through the tissue and into engagement with opposite ends of the discharged retainer.

The stapler is constructed so that the foremost retainer can be positioned in spaced parallel relation to the anvil across an incision in the fascia tissue. In addition, the foremost strap is expelled so as to first pass through one end of the positioned retainer and the tissue before being deflected by the anvil across the incision and, thence, through the tissue and the second end of the retainer. In this respect, the strap and retainer form a fascia staple of two-piece construction such as described in EP-A-0 315 344, which document falls under Art. 54 (3) EPC. This document discloses also an instrument for stapling an incision with fascia staples comprising a holder or magazine but not two cartridges.

The stapler can be embodied in a pistol-shaped housing from which a rotatable nose projects. In this case, the means for expelling the foremost strap from the strap cartridge for penetra-

tion through the tissue includes a plunger which extends into the strap cartridge for pushing the foremost strap therefrom and a pusher which is slidably mounted in the housing and connected to the plunger. In addition, a handle is pivotally mounted on the housing while a linkage is disposed between the handle and the pusher for movement of the pusher in response to pivoting of the handle. In this way, a surgeon may use one hand for firing of a strap from the strap cartridge. Depending upon the mechanical advantage of the linkage, the amount of force required for manual triggering of the stapler can be held to a minimum.

Both the strap cartridge and retainer cartridge are mounted within the nose of the housing along with the anvil so as to be rotated as a unit with the nose. In this way, the anvil and cartridges can be rotated into a position suitable for stapling without having to change the position of the handle for firing purposes.

An articulated linkage may also be provided to connect the pusher to the strap cartridge and retainer cartridge for moving the cartridges towards the anvil and out of the housing prior to expelling of the foremost strap. This permits the surgeon to see the positioned retainer prior to expelling of the strap therethrough.

The stapler may also be provided with a pair of movable approximators on opposite sides of the strap cartridge, each of which has a tissue engaging surface for approximating the tissue at the incision. In this case, the approximators are secured to the strap cartridge via a spring means in order to permit relative longitudinal movement therebetween. In use, the strap cartridge with the approximators would first move until the approximators abut the tissue to be stapled. This would be followed by a second movement of the strap cartridge relative to the approximators and then a movement of the foremost strap relative to the strap cartridge and the approximators. In this way, the approximators serve to initially grip the tissue in order to approximate the tissue at the incision followed by the actual stapling operation.

In order to cause the approximators to move towards each other during the relative movement of the strap cartridge, cam surfaces can be provided on the strap cartridge to abut the approximators and force the approximators towards each other.

The stapler may also be provided with a counter wheel to indicate the number of staples remaining in the cartridge as well as a lockout assembly to prevent firing of the stapler when empty.

Embodiments of the invention will now be described by way of example and by reference to the accompanying drawings, in which:

Fig. 1 illustrates a perspective cut-away view of a fascia stapler constructed in accordance with

the invention;

Fig. 2 illustrates an exploded view of the housing and pusher assembly of the stapler in accordance with the invention;

Fig. 3 illustrates an exploded view of the strap cartridge, retainer cartridge, anvil, approximators and articulated linkage in accordance with the invention;

Fig. 4 illustrates a partial cut-away perspective view of the components of Fig. 3;

Fig. 5 illustrates a partial cross-sectional view of the front end of the stapler in accordance with the invention;

Fig. 6 illustrates a top view of the lower part of the retainer cartridge prior to firing with a strap in place;

Fig. 7 illustrates a view similar to Fig. 6 with the approximators abutted against the fascia tissue;

Fig. 8 illustrates a view similar to Fig. 7 with the approximators being moved towards each other and immediately prior to expelling of the foremost strap;

Fig. 9 illustrates a view similar to Fig. 8 with the foremost strap fired from the strap cartridge;

Fig. 10 illustrates a view similar to Fig. 9 of the stapled incision with the stapler opened and with a strap in place for firing;

Fig. 11 illustrates an exploded view of a lockout assembly to prevent firing of the fascia stapler when empty in accordance with the invention;

Fig. 12 illustrates a view of the lockout assembly in a passive position;

Fig. 13 illustrates a view of the lockout assembly in a blocking position; and

Fig. 14 illustrates a view of an anvil in accordance with the invention.

Referring to Fig. 1, the fascia stapler (applicator) 10 includes a housing 11 of pistol shape having a L-shaped grip portion 12 and a nose 13 which is rotatably mounted within the grip portion 12. As illustrated, the nose 13 houses a retainer cartridge 14, a strap cartridge 15, an anvil 16 and a pair of approximators 17. In addition, a means is provided for expelling a foremost strap (not shown) from the strap cartridge 15 and includes a pusher assembly 18 and a trigger assembly 19.

Referring to FIGS. 1 and 2, the pusher assembly 18 includes a plunger 21 which is mounted for sliding within the strap cartridge 15, a pusher 22 connected to the plunger 21 and an adaptor 23 which is connected to the pusher 22 in a manner as to permit rotation of the pusher 22 about a central longitudinal axis of the adaptor. In this way, the nose 13 of the stapler 10 can be rotated relative to the grip portion 12 in order to position the anvil 16 and the cartridges 14, 15 relative to the tissue which is to be stapled.

The trigger assembly 19 includes a handle 24 which is pivotally mounted by a pin 25 (FIG. 2) in the grip portion 12 of the housing 11 and a two-armed lever 26 which is pivotally mounted on a pin 27 in the grip portion 12. As indicated in FIG. 1, a return spring 28 is connected between an aperture 29 in one arm of the lever 26 and a fixed pin 30 at the base of the grip portion 12 while a trigger pin 31 in the handle 24 secures the other end of the lever 26 within the handle 24 to permit pivoting therewith. Upon pivoting of the handle 24 towards the grip portion 12, the lever 26 pushes the pusher assembly 18 forwardly towards the anvil 16.

Referring to Fig. 2, wherein like reference characters indicate like parts as above, the grip portion 12 of the housing 11 is of split construction and is held together by the pins 25, 30. Referring to FIG. 2, the lever 26 is secured by a pin 32 at one end to the adaptor 23.

The adaptor 23 is provided with an outwardly extending block 33 on each side which is slidably received within a longitudinal slideway 34 of a respective half of the grip portion 12. In addition, the adaptor 23 has a cylindrical portion 35 which is provided with a bifurcated stem 36 with enlarged heads 37.

The pusher 22 is provided with a flanged portion 38 at the proximal end which has an aperture (not shown) to receive the bifurcated stem 36 of the adaptor 23 to secure the pusher 22 to the adaptor 23 in rotatable manner. The pusher 22 also includes a longitudinal blind bore 39 at the distal end which receives a proximal end of the plunger 21. Further, the plunger 21 has a serrated proximal end, for example, formed by two pairs of teeth 40 on top and bottom edges for engaging within the bore of the pusher 22 for locking the plunger 21 within the bore 39. The plunger 21 may be of any suitable material, such as a plastic material and has a suitable rigidity for pushing straps from the strap cartridge 15 (see Fig. 1).

Referring to Figs. 1 and 2, the housing 11 also contains a counter ring 41 which is rotatably mounted in suitable guideways 42 in the distal end of the grip portion 12. As indicated, the counter ring 41 has an internal diameter which permits passage of the pusher 22 therethrough. The counter ring 41 is also provided with a plurality of equi-spaced tabs 43 which are directed radially inwardly on the inside of the ring 41 as well as a U-shaped block 44 with two legs defining tabs. The number of tabs 43 corresponds to the number of staples within the stapler 10.

The counter wheel 41 cooperates with a means in the form of a lever 45 which is mounted at the end of a block 33 of the adaptor 23 for incrementally rotating the wheel 41 in response to movement of the pusher assembly 18 through the wheel 41.

For example, the lever 45 has a square aperture which is press fitted over a like-shaped stub 46 projecting from the block 33 and slides within a slideway 34 of the housing 12. As indicated, the lever 45 has a forward end 47 which is angled downwardly, as viewed, so as to engage under a tab 43 of the counter wheel 41. This end 47 carries a cam follower 47' which cooperates with a fixed cam 47" on the inside wall of the housing 12 adjacent the counter wheel 41. During operation, as the stapler 10 is actuated, the lever 26 pivots counter-clockwise, as viewed in Fig. 1 and moves the adapter 23 with the lever 45 forwardly. As the cam follower 47' on the downwardly angled end 47 of the lever 45 moves under the cam 47" the lever 45 pivots downwardly while moving into the plane of the counter wheel 41. A tab 43 is thus engaged. As the lever 45 continues to move forwardly a slight distance, the cam follower 47' passes by the cam 47" and the downwardly inclined end 47 snaps upwardly causing wheel 41 to rotate, for example, counter-clockwise as viewed in Fig. 2. Upon retraction of the adapter 23, the counter wheel 41 has moved into a position to be subsequently engaged by the lever 45. Of note, the U-shaped block 44 does not impede rotation of the wheel via the lever 45.

Referring to Fig. 2, the housing 11 is provided with a window 45' through which the counter wheel 41 can be viewed. In addition, the counter wheel 41 is provided with a sequence of numbers, for example, from 0 to 20 so that a user may determine the number of staples remaining in the stapler 10. Of note, the indicia may be provided on a label strip which is secured on the counter ring 41.

Referring to Fig. 3, the retainer cartridge 14 includes a molded base 48 and a cover plate 49 which is mounted thereon. The base 48 is sized so as to be secured to the underside of the nose 13 (see Fig. 1). In this respect, the underside of the proximal portion of the nose 13 has a slot 50 (see Fig. 2) in which the base 48 is slidably mounted. In addition, the nose 13 is provided with a pair of longitudinal grooves 51 while the base 48 is provided with splines 52 for sliding into the grooves 51.

Of note, the base 48 may be secured to the nose 13 in a fixed manner, for example by means of a keeper 53 (see Fig. 2) which is mounted in the nose 13 and is able to project at an intermediate part into a mating groove (not shown) in the retainer cartridge 14.

As indicated in Fig. 3, the cover plate 49 has a plurality of tabs 54 which interfit into notches 55 in the base 48 in order to secure the cover plate 49 in place as well as an upstanding tab 54' to act as a stop for limiting the forward motion of the approximators 17.

The retainer cartridge 14' also includes a supply of retainers 56 (only one of which is shown for simplicity), each of which is constructed, for example as described in EP-A-0 315 344.

In addition, means are provided for sequentially discharging the retainers 56 from the cartridge 14. As indicated, this means includes a spring assembly formed of a pair of constant force springs 57 which are coiled within the base 48 and secured via a bent-over tab 58 within a slot 59 in the base 48. The springs 57 tend to roll up in order to bias the retainers 56 in the distal direction. In addition, the means for discharging the retainers includes a ramp 60 which is integrally formed within the base 48 and along which the retainers 56 slide. As indicated, the distal end of the ramp 60, is curved upwardly to form a nose 61 so as to cause a retainer 56 moving along the ramp 60 to turn about the longitudinal axis thereof.

Each retainer 56 is of elongated shape and made of a resilient material which may also be absorbable. In addition, each retainer 56 has a main body portion 62, an enlarged proximal end having an opening 63 for passage of a strap and an enlarged distal end having a pair of flanges 64 and a web 65 (see Fig. 6) to form an opening or slot which is sized for passage of a strap. The retainer 56 also has a pair of projections or pins 66 which are shaped and sized to penetrate into fascia tissue on both sides of an incision.

When mounted on the base 48, each retainer 56 is initially disposed with the ends 63, 64 directed downwardly into grooves extending along the base 48, as indicated in Fig. 5. However, the foremost retainer 56 is guided by the curved distal end of the ramp 60 into a position turned 90° therefrom.

The base 48 also includes an elongated sleeve 67 for receiving a stem 68 of the anvil 16. In addition, the underside of the base 48 is provided with a recess (not shown) which receives an anvil pad (not shown) and an anvil stop (not shown) in press fit relation. The anvil stem 68 is provided with a notch 69 which receives a stop and an optional pad. The pad can be made of resilient material and abuts against the proximal end of the notch 69 in the stem 68 while the stop is mounted in a fixed position. The resilience of the pad can permit the anvil 16 to adjust to slightly different thickness of tissue which are to be stapled.

Referring to Fig. 3, the strap cartridge 15 includes a transparent plastic base 70 and a plastic cover 71 which are sandwiched together via pins 72 on the base and receiving holes (not shown) in the cover 71. The base 70 is provided with a central recess 73 in which a plurality of straps 74 (only one of which are shown for simplicity) are disposed. In addition, a spring assembly formed of

a pair of constant force springs 75 are provided to bias the straps 74 to one side of the base 70 and, in particular, to a longitudinal slot 76. Each spring 75 includes a bent over end 77 which is received within a slot 78 of the base 70 and functions in a manner similar to the springs 57 in the retainer cartridge 14 so as to bias the straps 74 into the slot 76. The slot 76, in turn, is aligned with the plunger 21 so as to slidably receive the plunger 21 in abutting relation to a foremost strap within the slot 76.

As illustrated in Fig. 3, each strap 74 is constructed in a manner as described in the above-noted EP-A-0 315 444. That is, each strap 74 is of a resilient and flexible material with a pointed distal end 79 for passage through the openings 63, 64 in a retainer 56 as well as an enlarged proximal end 80. Each strap 74 may also be provided with a means in the form of resilient teeth at the distal end for engaging with the distal end of a strap 56 in order to prevent withdrawal of the distal end of the strap from the opening 64 in the retainer as described below.

As shown, the distal end of the cartridge base 70 is recessed and is of a shape to receive an expelled retainer 56 from the retainer cartridge 14. In addition, a pair of spring fingers 81 are disposed on opposite sides of the recess in order to resiliently retain a retainer therein. As illustrated in Fig. 6, each spring finger 81 extends over the ends of a retained retainer 56 in order to hold the retainer 56 in place during stapling.

The strap cartridge cover 71 has a pair of abutments 82 which overlie the recess of the cartridge base 70 in order to prevent passage of a retainer 56 thereby. In addition, the cover 71 has an extension 83 at the proximal end having a pair of tabs 84 forming a bifurcated end through which a return pin 85 passes.

An articulated linkage 86 is connected to the pin 85 in order to connect the strap cartridge 15 to the pusher 22 (see Fig. 1). This linkage 86 is formed of a plurality of pivotally connected links 87 which can be moved from an extended position (as indicated in Fig. 3) to a collapsed position. As indicated, one pair of links 87 is pivotally mounted on the pin 85 of the cartridge cover 71 while a second pair of links is mounted on a pin 88 which is fixedly mounted within a bore 89 in the cover plate 49 of the retainer cartridge 14. A suitable retainer clip (not shown) 87 is provided to secure the links 87 to the pin 88. In addition, a pair of rivets 90 secure the foremost links to the rearmost links.

Referring to Fig. 1, each interconnecting rivet 90 of the articulated linkage 86 is received in a cam slot (not shown) within the pusher 22. The cam slots are shaped to initially effect a forward

movement of the strap cartridge 15 over the retainer cartridge 14 as the pusher 22 (Fig. 1) moves forwardly. During this time, the articulated linkage 86 moves from the extended position towards a collapsed position, that is, with the rivets 90 moving towards each other. This is due to the fixation of the pin 88 to the cover plate 49 of the retainer cartridge 14 which remains fixed in place. Thereafter, as the rivets 90 move to the inwardmost positions, the slots in the pusher 22 accommodate the rivets 90 while the pusher 22 moves further forward. At this time, the strap cartridge 15 becomes stationary and the plunger 21 moves through the strap cartridge 15.

Referring to Fig. 3, the approximators 17 are mounted on the bottom surfaces of the strap cartridge 15 within grooves (not shown) to move toward and away from each other in scissors-like fashion. One approximator 17 has a raised tang 91 at the proximal end with a slot 92 to receive a raised tab 93 of the other approximator 17 as well as one end of a spring 94 which engages a depending pin (not shown) on the underside of the cover 71. The spring 94 serves to permit a "lost motion" between the approximators 17 and the strap cartridge 15 as described below. The cartridge base 70 is provided with a cam 95 centrally disposed on the bottom side as well as cam surfaces 96 (as indicated in Fig. 6) for biasing the approximators 17. Upon rearward movement of the approximators 17 relative to the strap cartridge 15 due to abutment of the approximators 17 against fascia tissue, the spring 94 elongates and via the cam surfaces 96 brings the approximators 17 towards the central cam 95.

Referring to Figs. 5 and 6, the anvil 16 is provided with a grooved portion or channel 97 for guiding of a retainer 56 therein as described below.

Referring to Figs. 3 and 14, the anvil 16 is of two piece construction for assembly purposes. For example, the anvil 16 has a stem 68 of sheet metal which is folded over about a mid-line and a molded plastic head 98 which includes a slot 99 through which the stem 68 passes. In addition, the distal end of the stem 68 is shaped with a pair of ears 100 (Fig. 14) while the head 98 has a pair of flanged portions 101 provided with recesses to accommodate the ears 100 of the stem 68. Thus, in assembling the anvil 16, the stem 68 is slid through the head 98 from left to right as viewed in Fig. 14.

In order to use the fascia stapler 10, the anvil 16 is positioned as indicated in Figs. 5 and 7 within an incision defined by a pair of tissue sections 102. In particular, the anvil 16 is positioned so as to bridge over the incision.

Referring to Figs. 4 and 5, the fascia stapler 10 is normally delivered in a position with a foremost

retainer 56 and foremost strap 74 in place for firing. As illustrated, the strap cartridge 15 is disposed in overlying relation to the retainer cartridge 14 so that the foremost retainer 56 has been expelled into the recess at the forward end of the strap cartridge 15. In this position, the foremost retainer 56 is held in place by the spring fingers 81 (see Fig. 6), the overlying abutments 82 of the strap cartridge cover 71 and, from below, by the nose 61 of the ramp 60. The foremost strap 74 is positioned within the slot 76 of the staple cartridge base 70 and is abutted by the plunger 21.

After positioning of the anvil 16, the handle 24 (see Fig. 1) of the stapler is manually pivoted. This causes the lever 26 to move the pusher assembly 18 forwardly. During a first movement, the approximators 17 are brought into abutment with the tissue 102 on opposite sides of the incision as indicated in Fig. 7. At this time, the distal end of the strap cartridge 15 will have moved beyond the nose 13.

As the pusher assembly 18 continues to move forwardly, the approximators 17 cease further motion forwardly and begin to move inwardly towards each other under the influence of the cam surfaces 96 on the strap cartridge base 70 and the tissue. At the same time, the strap cartridge 15 continues to move forwardly relative to the approximators 17. In this respect, as indicated in Fig. 1, the rivets 90 of the articulated linkage 86 slide inwardly toward each other during the time that the approximators 17 are brought against the tissue. Thereafter, the rivets 90 enter angled portions of the cam slots (not shown) to accommodate the relative movement between the strap cartridge 15 and the now stationary approximators 17. Further, during this time, the articulated linkage 86 moves from the extended position into the predetermined collapsed position.

After the strap cartridge 15 has moved against the tissue 102 (Fig. 8) to clamp the tissue, the motion of the cartridge 15 ceases. At this time, the pusher assembly 18 continues to move forwardly so as to push the plunger 21 into the slot 76 of the strap cartridge base 70 causing the forwardmost strap 74 to be expelled, thus firing the stapler. During this time, the pointed distal end of the strap 74 initially passes through the opening 63 of the retainer 56 and then pierces through the layer of tissue 102 to abut the anvil 16. As the strap 74 continues to be pushed, the strap slides within the groove 97 of the anvil 16 so as to pierce through the tissue 102 on the other side of the incision and enter into the opening 64 of the retainer 56 so as to be engaged therein via the rib 65 and teeth of the strap 74.

During the motion of the plunger 21 through the strap cartridge base 70, the articulated linkage

86 remains in the collapsed position i.e. firing position (Fig. 1). In this position, the pusher assembly 18 is free to move relative to the stationary strap cartridge 15.

After the foremost strap 74 has been passed through the tissue 102 into the foremost retainer 56, the handle 24 is in a fully closed position. At this time, the lever 45 will have rotated the counter wheel 41 over an increment equal to the spacing between two tabs 43 with a corresponding change in the number appearing in the window 45'.

Upon release of the handle 24, the spring 28 (Fig. 1) pulls the lever 26 in a clockwise direction, as viewed, so as to pull the pusher assembly 18 rearwardly. This retracts the strap cartridge 15 and the approximators 17 from the stapled incision as indicated in Fig. 10. At this time, the spring fingers 81 of the strap cartridge 15 deflect outwardly to permit outward passage of the retainer 56. During this time also, the next forwardmost retainer 56 in the retainer cartridge 14 is initially held in a position between the ramp 60 and the forward end of the cover plate 49 in the already turned position. As soon as the strap cartridge 15 slides past the forward end of the cover 49, the spring assembly 57 within the retainer cartridge base 48 biases the next foremost retainer 56 into the now overlying recessed portion of the strap cartridge base 70 and another retainer 56 is moved into position between the end of the ramp 60 and the end of the cover 49.

Further operation of the stapler 10 causes subsequent retainers 56 and straps 74 to be expelled so as to further suture the incision in the tissue 102. Prior to a complete closing of the incision, the anvil 16 must be removed and the remainder of the incision sutured in a conventional manner.

Referring to Fig. 2, the stapler 10 includes a lockout assembly 103 to prevent firing of the stapler 10 when empty. This assembly 103 includes a U-shaped trigger 104 which is slidably mounted in a slot 105 of a block 33 of the adapter 23, a bolt 106 which is mounted perpendicular to the trigger 104 within the block 33 and a spring 107 in the block 33 for biasing the bolt 106 outwardly.

As indicated in Fig. 11, the trigger 104 defines a slot of uniform width less than the height of the bolt 104 with an enlarged portion 108 near one end greater than the height of the bolt 104 to permit passage of the bolt 106. In addition, the bolt 106 has an intermediate narrowed portion 109 sized to slide within the slot of the trigger 104 and a distal end sized to project through a window 110 (Fig. 1) in the housing portion 12.

The trigger 104 also has a distal end of a width less than the clear space between adjacent tabs 43 of the counter wheel 41 (Fig. 12) but greater than the spacing between the legs of the block 44 (Fig.

13).

In normal position, the trigger 104 blocks the bolt 106 from movement out of the adapter (Fig. 11).

During operation of the stapler 10, as the adapter 23 moves forward and a staple is fired, the trigger 104 moves into position between two tabs 43 of the counter wheel 43 (Fig. 12). In this position, the bolt 106 remains blocked against movement from the adapter 23. Should, however, the stapler 10 be empty, the U-shaped block 44 of the counter wheel 41 will be in the path of the trigger 104. Hence, should an attempt be made to fire the stapler 10, the trigger 104 will be brought into the position shown in Fig. 13 wherein the block 44 stops movement of the trigger 104. As the adapter 23 continues to move forwardly relative to the stopped trigger 104, the bolt 106 slides into alignment with the enlarged portion of the slot in the trigger 104 and is sprung therethrough under the bias of the spring 107 into and through the window 110 (Fig. 2) of the housing portion 12. Continued motion of the adapter 23 is, then, prevented and the adapter 23 locked in place. Likewise, the handle 24 of the stapler 10 becomes locked in a closed position.

As indicated in Fig. 2, the trigger 104 carries a raised flange 111 at the proximal end to abut the rear end of the block 33 to preclude movement out of the slot 105.

Referring to Figs. 1 and 2, the fascia stapler 10 is also provided with a ratchet system to insure that a firing stroke is completed. This ratchet system employs a pawl 112 which is mounted over the block 33 of the adapter 23 and a toothed rack 113 mounted in one half of the grip portion 12 (see Fig. 2). The pawl 112 is in the form of a clip 114, such as a plastic clip, which is slid over the adapter block 33 and held against rotation about the block 33 due to the shape of clip 114. In addition, an integral tab 115 extends rearwardly and downwardly from the clip 114 to engage with the teeth of the rack 113.

During a first stroke, the handle 24 pivots counter-clockwise, as viewed, so that lever 26 pushes the pusher assembly 18 forwardly. During this time, the tab 115 of the pawl clip 114 steps over the teeth of the rack 113. Should the handle 24 not complete a first stroke, the pawl tab 115 will remain in engagement with the rack 113 to prevent rearward movement of the pusher assembly 18. At the completion of a firing stroke, the pawl tab 115 will have passed beyond the teeth of the rack 113. The tab 115 then pivots clockwise slightly while being biased inwardly of the housing 12 by an inclined surface (not shown) at the forward end of the rack 113 so as to lie beside the rack 113. During the return movement of the pusher assembly 18, the

tab 115 slides alongside the rack 113 without engaging with the teeth. After passing by the rack 113, the tab 115 springs back to the original position for a subsequent firing stroke.

As indicated in Fig. 2, the pawl clip 114 has a top part 116 and a back wall 117 which form a peaked portion spaced from the block 33 so as to flex and accommodate flexing of the tab 115 by the rack 113 during the return stroke of the pusher assembly 18.

The stapler may be constructed so as to be disposable after emptying of one or both of the respective cartridges 14, 15. Alternatively, the stapler may be constructed for re-use. In this respect, the retainer cartridge 14 can be slidably removed from the nose 13. Thereafter, the base 70 of the strap cartridge 15 can be removed from the cover 71 which remains in place. A fresh transparent base 70 filled with straps 71 can then be reinserted in a snap-fit arrangement into the cover 71 and a fresh retainer cartridge 14 can be slid into place.

Of note, the anvil 16 may be adjusted within the retainer cartridge 14 to accommodate different thicknesses of tissue, that is, by moving the stem 68 more or less into the slot 67 and locking the stem in place.

The invention thus provides a fascia stapler of relatively simple construction which can be readily manipulated by a surgeon. Further, the invention provides a fascia stapler by means of which incisions in fascia tissue can be readily closed.

Claims

1. A fascia stapler (10) for stapling an incision comprising:
 - an anvil (16);
 - a retainer cartridge (14) housing a plurality of elongate retainers (56) and having means (57, 60) for sequentially discharging a foremost retainer therefrom into spaced parallel relation to said anvil for disposition across an incision;
 - a strap cartridge (15) housing a plurality of flexible elongate straps and having means for positioning a foremost strap in alignment with one end of the discharged retainer from said cartridge; and
 - means (18) for expelling said foremost strap from said strap cartridge in a direction towards said anvil for penetration through the tissue and into engagement with opposite ends of said discharged retainer.
2. A stapler as claimed in claim 1, wherein said means in said retainer cartridge includes a spring assembly (57) biasing said retainers in a direction out of said retainer cartridge and a ramp (60) for directing a foremost retainer out

of said retainer cartridge.

3. A stapler as claimed in claim 1 or 2, wherein said strap cartridge is positioned in overlying relation to said retainer cartridge and includes means for receiving said foremost retainer in alignment with said foremost strap.
4. A stapler as claimed in any one of the preceding claims, wherein said anvil includes a mounting shaft (68) mounted in said retainer cartridge.
5. A stapler as claimed in any one of the preceding claims, wherein said means (18) for expelling said foremost strap from said strap cartridge includes a reciprocally mounted plunger (21) for pushing said foremost strap from said strap cartridge (15).
6. A stapler as claimed in claim 5, wherein said means for expelling said foremost strap includes a reciprocally mounted pusher (22) and which further comprises an articulated linkage (86) connecting said pusher (22) to said strap cartridge (15) for moving said strap cartridge towards said anvil prior to expelling of said foremost strap.
7. A stapler as claimed in claim 5 or 6, wherein said means for expelling said foremost strap includes a pusher assembly (18) having a (or the) pusher (22) abutting said plunger (21), a pivotally mounted handle (24) for triggering said pusher assembly and a linkage (26) between said handle and said pusher assembly.
8. A stapler as claimed in claim 7, which further comprises a housing (11) for said linkage and said pusher assembly (18) and having said handle pivotally mounted thereon and a nose (13) rotatably mounted on said housing and housing said cartridges therein.
9. A stapler as claimed in claim 7 or 8, further comprising a counter wheel (41) rotatably mounted about said pusher assembly and having a plurality of inwardly directed tabs (43) and a sequence of numbers thereon, and a lever (45) mounted on said pusher assembly for selectively engaging one of said tabs to rotate said wheel in response to movement of said pusher assembly through said wheel.
10. A stapler as claimed in claim 9, further comprising a lockout assembly (103) to lock said pusher assembly in place in response to said staple cartridges being empty.
11. A stapler as claimed in claim 10 wherein said lockout assembly includes a trigger (104) for abutting said wheel in an empty stapler position and having an opening therein, a bolt (106) disposed perpendicularly to said trigger and sized to pass through said opening in said position and a spring (107) biasing said bolt through said opening.
12. A stapler as claimed in any one of the preceding claims, which further comprises at least one pair of movably mounted approximators (17) having tissue engaging surfaces for positioning on opposite sides of an incision and means (96) for moving said approximators toward each other prior to expelling of said foremost strap to approximate the tissue about the incision.
13. A stapler as claimed in claim 12, wherein said approximators are mounted on said strap cartridge.
14. A stapler as claimed in claim 13, which further comprises spring means (94) securing said approximators to said strap cartridge to permit relative longitudinal motion therebetween during movement of said strap cartridge towards said anvil.
15. A stapler as claimed in claim 14, wherein said pusher (22) includes a pair of cam slots therein and said articulated linkage includes a pair of rivets, each said rivet being slidably mounted in a respective slot and said slots being shaped to effect a first movement of said strap cartridge with said approximators, a second movement of said strap cartridge relative to said approximators and a third movement of said foremost strap relative to said strap cartridge and said approximators.
16. A stapler as claimed in claim 14 or 15, wherein said strap cartridge has cam surfaces thereon for moving said approximators towards each other during relative movement between said approximators and said strap cartridge.
17. A fascia stapler as claimed in any one of the preceding claims, and comprising:
 - a housing (11) having a nose (13) extending therefrom;
 - the retainer cartridge (14) being mounted in said nose;
 - the strap cartridge (15) being mounted in said nose;
 - the anvil (16) extending from said nose in opposition to said cartridges; and

the means (18) for expelling said foremost strap from said strap cartridge in a direction towards said anvil being within the housing.

18. A stapler as claimed in claim 17, wherein said means for expelling said foremost strap are slidably mounted in said housing.
19. A stapler as claimed in claim 18 which further comprises an articulated linkage (86) connecting said pusher to said strap cartridge for moving said strap cartridge towards said anvil prior to expelling of said foremost strap.
20. A stapler as claimed in claim 19, wherein said pusher (22) includes a pair of cam slots therein and said articulated linkage includes a pair of rivets (90), each said rivet being slidably mounted in respective slot and said slots being shaped to effect a first movement of said strap cartridge relative to said retainer cartridge and a second movement of said foremost strap relative to said strap cartridge.
21. A stapler as claimed in claim 18, 19 or 20, wherein said means (18) for expelling said foremost strap includes a handle (24) pivotally mounted on said housing and a linkage (26) between said handle and said pusher for moving said pusher in response to pivoting of said handle.
22. A stapler as claimed in any one of the preceding claims, and which comprises:
 - a housing (11);
 - a pusher assembly (18) movably mounted in said housing between a rest position and a fired position;
 - a handle (24) articulated to said housing and said pusher assembly for reciprocating said pusher assembly between said positions;
 - a toothed rack (113) secured to and within said housing; and
 - a pawl (112) mounted on said pusher assembly and having a depending tab (115) for selectively engaging said rack during movement of said pusher assembly from said rest position towards said firing position.
23. A stapler as claimed in claims 22, wherein said rack has an inclined surface at a forward end to deflect said tab to a position beside said rack for passing by said rack during movement of said pusher assembly from said firing position to set rest position.
24. A stapler as claimed in claim 22 or 23, as dependent on claim 9, which further comprises

a cam on said housing adjacent the counter wheel (41) and a window (45') in said housing for viewing said counter wheel and wherein said lever (45) has a cam follower (47') thereon for engaging a cam (47'') to deflect said lever under a tab (43) of said counter wheel during movement of said lever towards said counter wheel.

Patentansprüche

1. Fascia-Klammergerät (10) zum Klammern eines Schnittes, umfassend:
 - ein Gegenlager (16);
 - eine Halterkassette (14), die eine Mehrzahl von langgestreckten Haltern (56) beherbergt und eine Einrichtung (57, 60) aufweist, um einen jeweils vordersten Halter für eine Anordnung über einen Schnitt aus dieser in eine parallele Beziehung im Abstand von dem besagten Gegenlager abzugeben;
 - eine Bügelkassette (15), die eine Mehrzahl von biegsamen langgestreckten Bügeln beherbergt und eine Einrichtung aufweist, um einen vordersten Bügel mit einem Ende des aus der besagten Kassette abgegebenen Halters fluchtend zu positionieren; und
 - eine Einrichtung (18) zum Heraustreiben des besagten vordersten Bügels aus der besagten Bügelkassette in Richtung des besagten Gegenlagers für ein Eindringen durch das Gewebe und in Eingriff mit entgegengesetzten Enden des besagten abgegebenen Halters.
2. Klammergerät nach Anspruch 1, dadurch gekennzeichnet, daß die besagte Einrichtung in der besagten Halterkassette eine Federeinheit (57) einschließt, welche die besagten Halter in einer Richtung aus der besagten Halterkassette heraus unter Vorspannung hält, sowie eine Schräge (60), um einen vordersten Halter aus der besagten Halterkassette heraus zu leiten.
3. Klammergerät nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß die besagte Bügelkassette in Überlagernder Beziehung zu der besagten Halterkassette positioniert ist und eine Einrichtung einschließt, um den besagten vordersten Halter mit dem besagten vordersten Bügel fluchtend aufzunehmen.
4. Klammergerät nach einem beliebigen der vorangehenden Ansprüche, dadurch gekennzeichnet, daß das besagte Gegenlager in der besagten Halterkassette angebrachten Befestigungsschaft (68) einschließt.

5. Klammergerät nach einem beliebigen der vorangehenden Ansprüche, dadurch gekennzeichnet, daß die besagte Einrichtung (18) zum Heraustreiben des besagten vordersten Bügels aus der besagten Bügelkassette einen hin- und herbeweglich angebrachten Kolben (21) einschließt, um den besagten vordersten Bügel aus der besagten Bügelkassette (15) zu stoßen. 5
6. Klammergerät nach Anspruch 5, dadurch gekennzeichnet, daß die besagte Einrichtung zum Heraustreiben des besagten vordersten Bügels einen hin- und herbeweglich angebrachten Ausstoßer (22) einschließt, und welches weiter eine den besagten Ausstoßer (22) mit der besagten Bügelkassette (15) verbindende Gelenkverbindung (86) umfaßt, um die besagte Bügelkassette vor einem Heraustreiben des besagten vordersten Bügels in Richtung des besagten Gegenlagers zu bewegen. 10
7. Klammergerät nach Anspruch 5 oder 6, dadurch gekennzeichnet, daß die besagte Einrichtung zum Heraustreiben des besagten vordersten Bügels eine Ausstoßereinheit (18) mit einem (oder dem) gegen den besagten Kolben (21) anstoßenden Ausstoßer (22), einen schwenkbar angebrachten Handgriff (24) zum Auslösen der besagten Ausstoßereinheit, sowie eine Verbindung (26) zwischen dem besagten Handgriff und der besagten Ausstoßereinheit einschließt. 15
8. Klammergerät nach Anspruch 7, dadurch gekennzeichnet, daß es weiter ein Gehäuse (11) für die besagte Verbindung und die besagte Ausstoßereinheit (18) umfaßt, und den besagten Handgriff schwenkbar daran angebracht aufweist, sowie eine Nase (13), die drehbar an dem besagten Gehäuse angebracht ist und die besagten Kassetten darin beherbergt. 20
9. Klammergerät nach Anspruch 7 oder 8, dadurch gekennzeichnet, daß es weiter ein Zählerrad (41) umfaßt, das um die besagte Ausstoßereinheit drehbar angebracht ist und eine Mehrzahl von nach innen gerichteten Zungen (43) und eine Folge von Zahlen darauf aufweist, sowie einen an der besagten Ausstoßereinheit angebrachten Hebel, um selektiv mit einer der besagten Zungen in Eingriff zu treten, um das besagte Rad ansprechend auf eine Bewegung der besagten Ausstoßereinheit durch das besagte Rad zu drehen. 25
10. Klammergerät nach Anspruch 9, dadurch gekennzeichnet, daß es weiter eine Verriegelungseinheit (103) umfaßt, um die besagte Ausstoßereinheit ansprechend auf ein Leersein der besagten Klammerkassetten in ihrer Lage zu verriegeln. 30
11. Klammergerät nach Anspruch 10, dadurch gekennzeichnet, daß die besagte Verriegelungseinheit einschließt: einen Auslöser (104) zum Anschlagen gegen das besagte Rad in einer Stellung bei leerem Klammergerät und mit einer Öffnung darin, einen Riegel (106), der senkrecht zu dem besagten Auslöser angeordnet und so bemessen ist, daß er in der besagten Stellung durch die besagte Öffnung hindurchtritt, sowie eine Feder (107), die den besagten Riegel durch die besagte Öffnung hindurch vorspannt. 35
12. Klammergerät nach einem beliebigen der vorangehenden Ansprüche, dadurch gekennzeichnet, daß es weiter mindestens ein Paar beweglich angebrachte Approximatoren (17) mit Gewebeeingriffsflächen zum Positionieren auf entgegengesetzten Seiten eines Schnittes umfaßt, sowie eine Einrichtung (96), um die besagten Approximatoren vor einem Heraustreiben des besagten vordersten Bügels aufeinanderzu zu bewegen, um das Gewebe um den Schnitt herum zur Annäherung zu bringen. 40
13. Klammergerät nach Anspruch 12, dadurch gekennzeichnet, daß die besagten Approximatoren auf der besagten Bügelkassette angebracht sind. 45
14. Klammergerät nach Anspruch 13, dadurch gekennzeichnet, daß es weiter eine Federeinrichtung (94) umfaßt, welche die besagten Approximatoren so an der besagten Bügelkassette befestigt, daß während der Bewegung der besagten Bügelkassette in Richtung des besagten Gegenlagers eine relative Längsbewegung zwischen diesen möglich ist. 50
15. Klammergerät nach Anspruch 14, dadurch gekennzeichnet, daß der besagte Ausstoßer (22) ein Paar Nockenschlitze darin einschließt, und daß die besagte Gelenkverbindung ein Paar Niete einschließt, wobei jeder besagte Niet in einem jeweiligen Schlitz verschiebbar angebracht ist, und die besagten Schlitze so geformt sind, daß sie eine erste Bewegung der besagten Bügelkassette zusammen mit den besagten Approximatoren, in zweite Bewegung der besagten Bügelkassette relativ zu den besagten Approximatoren und eine dritte Bewegung des besagten vordersten Bügels relativ zu der besagten Bügelkassette und den 55

besagten Approximatoren bewirken.

16. Klammergerät nach Anspruch 14 oder 15, dadurch gekennzeichnet, daß die besagte Bügelkassette Nockenoberflächen darauf aufweist, um die besagten Approximatoren während der Relativbewegung zwischen den besagten Approximatoren und der besagten Bügelkassette aufeinanderzu zu bewegen. 5
17. Fascia-Klammergerät nach einem beliebigen der vorangehenden Ansprüche, dadurch gekennzeichnet, daß es umfaßt:
 - ein Gehäuse (11) mit einer Nase (13), die sich aus diesem erstreckt;
 - wobei die Halterkassette (14) in der besagten Nase angebracht ist;
 - wobei die Bügelkassette (15) in der besagten Nase angebracht ist;
 - wobei sich das Gegenlager (16) den besagten Kassetten gegenüberliegend aus der besagten Nase erstreckt; und
 - wobei sich die Einrichtung (18) zum Heraustreiben des besagten vordersten Bügels aus der besagten Bügelkassette in Richtung des besagten Gegenlagers innerhalb des Gehäuses befindet. 10 15 20 25
18. Klammergerät nach Anspruch 17, dadurch gekennzeichnet, daß die besagte Einrichtung zum Heraustreiben des besagten vordersten Bügels verschiebbar in dem besagten Gehäuse angebracht ist. 30
19. Klammergerät nach Anspruch 18, dadurch gekennzeichnet, daß es weiter eine den besagten Ausstoßer mit der besagten Bügelkassette verbindende Gelenkverbindung (86) umfaßt, um die besagte Bügelkassette vor einem Heraustreiben des besagten vordersten Bügels in Richtung des besagten Gegenlagers zu bewegen. 35 40
20. Klammergerät nach Anspruch 19, dadurch gekennzeichnet, daß der besagte Ausstoßer (22) ein Paar Nockenschlitze darin einschließt, und daß die besagte Gelenkverbindung ein Paar Miete einschließt, wobei jeder besagte Niet in einem jeweiligen Schlitz verschiebbar angebracht ist, und die besagten Schlitze so geformt sind, daß sie eine erste Bewegung der besagten Bügelkassette relativ zu der besagten Halterkassette und eine zweite Bewegung des besagten vordersten Bügels relativ zu der besagten Bügelkassette bewirken. 45 50 55
21. Klammergerät nach Anspruch 18, 19 oder 20, dadurch gekennzeichnet, daß die besagte Ein-

richtung (18) zum Heraustreiben des besagten vordersten Bügels einen schwenkbar an dem besagten Gehäuse angebrachten Handgriff (24) und eine Verbindung (26) zwischen dem besagten Handgriff und dem besagten Ausstoßer einschließt, um den besagten Ausstoßer ansprechend auf ein Verschwenken des besagten Handgriffes zu bewegen.

22. Klammergerät nach einem beliebigen der vorangehenden Ansprüche, dadurch gekennzeichnet, daß es umfaßt:
 - ein Gehäuse (11);
 - eine in dem besagten Gehäuse zwischen einer Ruhestellung und einer abgefeuerten Stellung beweglich angebrachte Ausstoßereinheit (18);
 - einen an dem besagten Gehäuse und der besagten Ausstoßereinheit angelenkten Handgriff (24), um die besagte Ausstoßereinheit zwischen den besagten Stellungen hin- und herzubewegen;
 - eine an den besagten Gehäuse befestigte und innerhalb des besagten Gehäuses liegende Zahnstange (113); und
 - eine Sperrklinke (112), die an der besagten Ausstoßereinheit angebracht ist und eine herabhängende Zunge (115) aufweist, um während einer Bewegung der besagten Ausstoßereinheit aus der besagten Ruhestellung in Richtung der besagten Abfeuerstellung selektiv mit der besagten Zahnstange in Eingriff zu treten. 10 15 20 25 30
23. Klammergerät nach Anspruch 22, dadurch gekennzeichnet, daß die Zahnstange an einem vorderen Ende eine geneigte Oberfläche aufweist, um die besagte Zunge in eine Lage neben der besagten Zahnstange auszulenken, so daß sie sich während einer Bewegung der besagten Ausstoßereinheit aus der besagten Abfeuerstellung in die besagte Ruhestellung an der besagten Zahnstange vorbeibewegt. 35 40
24. Klammergerät nach den auf Anspruch 9 rückbezogenen Ansprüchen 22 oder 23, dadurch gekennzeichnet, daß es weiter einen Nocken auf dem besagten Gehäuse benachbart zu dem Zählerrad (41) und ein Fenster (45') in dem besagten Gehäuse zum Betrachten des besagten Zählerrades umfaßt, und daß der besagte Hebel (45) ein besagtes Gleitstück (47') darauf aufweist, um mit einem Nocken (47'') in Eingriff zu treten, um den besagten Hebel während einer Bewegung des besagten Hebels in Richtung des besagten Zählerrades unter eine Zunge (43) des besagten Zählerrades auszulenken. 45 50 55

R revendications

1. Instrument d'agrafage (10) du fascia pour agrafer une incision comprenant:
 - une enclume (16);
 - une cartouche d'éléments de retenue (14) logeant une pluralité d'éléments de retenue allongés (56) possédant un moyen (57, 60) pour décharger séquentiellement un élément de retenue le plus avant de celle-ci en une relation parallèle espacée à ladite enclume pour la disposition sur une incision;
 - une cartouche de bandes (15) logeant une pluralité de bandes flexibles allongées et possédant un moyen pour positionner la bande la plus avant en alignement avec une extrémité de l'élément de retenue déchargé de ladite cartouche; et
 - un moyen (18) pour expulser ladite bande la plus avant de ladite cartouche de bandes dans une direction vers ladite enclume pour la pénétration à travers le tissu et en prise avec les extrémités opposées dudit élément de retenue déchargé.
2. Instrument d'agrafage selon la revendication 1, dans lequel ledit moyen dans ladite cartouche comprenant les éléments de retenue renferme un ensemble à ressorts (57) sollicitant lesdits éléments de retenue suivant une direction hors de ladite cartouche comprenant les éléments de retenue et une rampe (60) pour diriger un élément de retenue le plus avant hors de ladite cartouche comprenant les éléments de retenue.
3. Instrument d'agrafage selon la revendication 1 ou 2, dans lequel ladite cartouche de bandes est positionnée en une relation de recouvrement à ladite cartouche comprenant les éléments de retenue et comprend un moyen pour recevoir ledit élément de retenue le plus avant en alignement avec ladite bande la plus avant.
4. Instrument d'agrafage selon l'une des revendications précédentes, dans lequel ladite enclume comprend un arbre de montage (68) monté dans ladite cartouche comprenant les éléments de retenue.
5. Instrument d'agrafage selon l'une des revendications précédentes, dans lequel ledit moyen (18) pour expulser ladite bande la plus avant de ladite cartouche de bandes comprend un plongeur (21) monté en vue d'un mouvement de va-et-vient pour pousser ladite bande la plus avant de ladite cartouche de bandes (15).
6. Instrument d'agrafage selon la revendication 5, dans lequel ledit moyen pour expulser ladite bande la plus avant comprend un poussoir (22) monté en vue d'un mouvement de va-et-vient et qui comprend en outre une liaison articulée (86) connectant ledit poussoir (22) à ladite cartouche de bandes (15) pour amener ladite cartouche de bandes vers ladite enclume avant l'expulsion de la bande la plus avant.
7. Instrument d'agrafage selon la revendication 5 ou 6, dans lequel ledit moyen pour expulser ladite bande la plus avant comprend un ensemble poussoir (18) possédant un (ou le) poussoir (22) en butée contre ledit plongeur (21), une poignée (24) montée de façon pivotante pour déclencher ledit ensemble poussoir et une liaison (26) entre ladite poignée et ledit ensemble poussoir.
8. Instrument d'agrafage selon la revendication 7, qui comprend en outre un boîtier (11) pour ladite liaison et ledit ensemble poussoir (18) et sur lequel est montée ladite poignée de façon pivotante, et un nez (13) monté de façon rotative sur ledit boîtier et logeant lesdites cartouches à l'intérieur.
9. Instrument d'agrafage selon la revendication 7 ou 8, comprenant en outre une roue de compteur (41) montée à rotation autour dudit ensemble poussoir et possédant une pluralité de pattes (43) dirigées vers l'intérieur et une séquence de nombres sur celle-ci, et un levier (45) monté sur ledit ensemble poussoir pour la mise en prise sélective avec une desdites pattes afin de faire tourner ladite roue en réponse au déplacement dudit ensemble poussoir par ladite roue.
10. Instrument d'agrafage selon la revendication 9, comprenant en outre un ensemble de verrouillage (103) afin de verrouiller ledit ensemble poussoir en place lorsque lesdites cartouches de l'agrafeuse sont vides.
11. Instrument d'agrafage selon la revendication 10, dans lequel ledit ensemble de verrouillage comprend une gachette (104) butant contre ladite roue dans une position où l'agrafeuse est vide et possédant une ouverture à l'intérieur, un boulon (106) disposé perpendiculairement à ladite gachette et dimensionné pour passer à travers ladite ouverture dans ladite position, et un ressort (107) sollicitant ledit boulon à travers ladite ouverture.

12. Instrument d'agrafage selon l'une des revendications précédentes, qui comprend en outre au moins une paire d'éléments d'approche (17) montés de façon déplaçable possédant des surfaces de mise en prise avec le tissu en vue du positionnement aux côtés opposés d'une incision, et un moyen (96) pour déplacer lesdits éléments d'approche l'un vers l'autre avant l'expulsion de la bande la plus avant pour approcher le tissu autour de l'incision.
13. Instrument d'agrafage selon la revendication 12, dans lequel lesdits éléments d'approche sont montés sur ladite cartouche de bandes.
14. Instrument d'agrafage selon la revendication 13, qui comprend en outre un moyen à ressort (94) fixant lesdits éléments d'approche à ladite cartouche de bandes pour permettre un mouvement relatif longitudinal entre ceux-ci pendant le déplacement de ladite cartouche de bandes vers ladite enclume.
15. Instrument d'agrafage selon la revendication 14, dans lequel ledit poussoir (22) comprend une paire de fentes de came à l'intérieur, et ladite liaison articulée comprend une paire de rivets, chacun desdits rivets étant monté de façon coulissante dans une fente respective, et lesdites fentes étant configurées pour effectuer un premier mouvement de ladite cartouche de bandes avec lesdits éléments d'approche, un deuxième mouvement de ladite cartouche de bandes relativement auxdits éléments d'approche et un troisième mouvement de ladite bande la plus avant relativement à ladite cartouche de bandes et auxdits éléments d'approche.
16. Instrument d'agrafage selon la revendication 14 ou 15, dans lequel ladite cartouche de bandes possède des surfaces de came sur celle-ci pour déplacer lesdits éléments d'approche l'un vers l'autre pendant le mouvement relatif entre lesdits éléments d'approche et ladite cartouche de bandes.
17. Instrument d'agrafage du fascia selon l'une des revendications précédentes, et comprenant:
un boîtier (11) possédant un nez (13) s'étendant de celui-ci;
la cartouche de retenue (14) étant montée dans ledit nez;
la cartouche de bandes (15) étant montée dans ledit nez;
l'enclume (16) s'étendant dudit nez en opposition auxdites cartouches; et
le moyen (18) pour expulser ladite bande la plus avant de la cartouche de bandes dans une direction vers l'adit enclume se trouvant à l'intérieur du boîtier.
18. Instrument d'agrafage selon la revendication 17, dans lequel ledit moyen pour expulser ladite bande la plus avant est monté de façon coulissante dans ledit boîtier.
19. Instrument d'agrafage selon la revendication 18, qui comprend en outre une liaison articulée (86) reliant ledit poussoir à ladite cartouche de bandes pour déplacer ladite cartouche de bandes vers ledit enclume avant l'expulsion de la bande la plus avant.
20. Instrument d'agrafage selon la revendication 19, dans lequel ledit poussoir (22) comprend une paire de fentes de came à l'intérieur, et ladite liaison articulée comprend une paire de rivets (90) chacun desdits rivets étant monté de façon coulissante dans la fente respective, et lesdites fentes étant configurées pour permettre un premier mouvement de ladite cartouche de bandes relativement à ladite cartouche comprenant les éléments de retenue, et un deuxième mouvement de ladite bande la plus avant relativement à ladite cartouche de bandes.
21. Instrument d'agrafage selon la revendication 18, 19 ou 20, dans lequel ledit moyen (18) pour expulser ladite bande la plus avant comprend une poignée (24) montée de façon pivotante sur ledit boîtier et une liaison (26) entre ladite poignée et ledit poussoir pour déplacer ledit poussoir en réponse au pivotement de ladite poignée.
22. Instrument d'agrafage selon l'une des revendications précédentes, et qui comprend:
un boîtier (11);
un ensemble poussoir (18) monté de façon déplaçable dans ledit boîtier entre une position de repos et une position tirée;
une poignée (24) articulée audit boîtier et audit ensemble poussoir pour faire alterner ledit ensemble poussoir entre lesdites positions;
une crémaillère dentée (113) fixée à et à l'intérieur dudit boîtier; et
un doigt (112) monté sur ledit ensemble poussoir et possédant une patte s'étendant vers le bas (115) pour la mise en prise sélective de ladite crémaillère pendant le déplacement dudit ensemble poussoir de ladite position de repos vers ladite position de tir.

23. Instrument d'agrafage selon la revendication 22, dans lequel ladite crémaillère possède une surface inclinée à une extrémité avant afin de dévier ladite patte vers une position à côté de ladite crémaillère pour passer devant ladite crémaillère pendant le déplacement dudit ensemble poussoir de ladite position de tir à ladite position de repos réglée. 5
24. Instrument d'agrafage selon la revendication 22 ou 23, dépendant de la revendication 9, qui comprend en outre une came sur ledit boîtier adjacente à ladite roue de compteur (41) et une fenêtre (45') dans ledit boîtier pour permettre la vue sur ladite roue de compteur, et dans lequel ledit levier (45) possède un suiveur de came (47') sur celui-ci pour la mise en prise avec une came (47'') afin de dévier ledit levier sous une patte (43) de ladite roue de compteur pendant le déplacement dudit levier vers ladite roue de compteur. 10 15 20

25

30

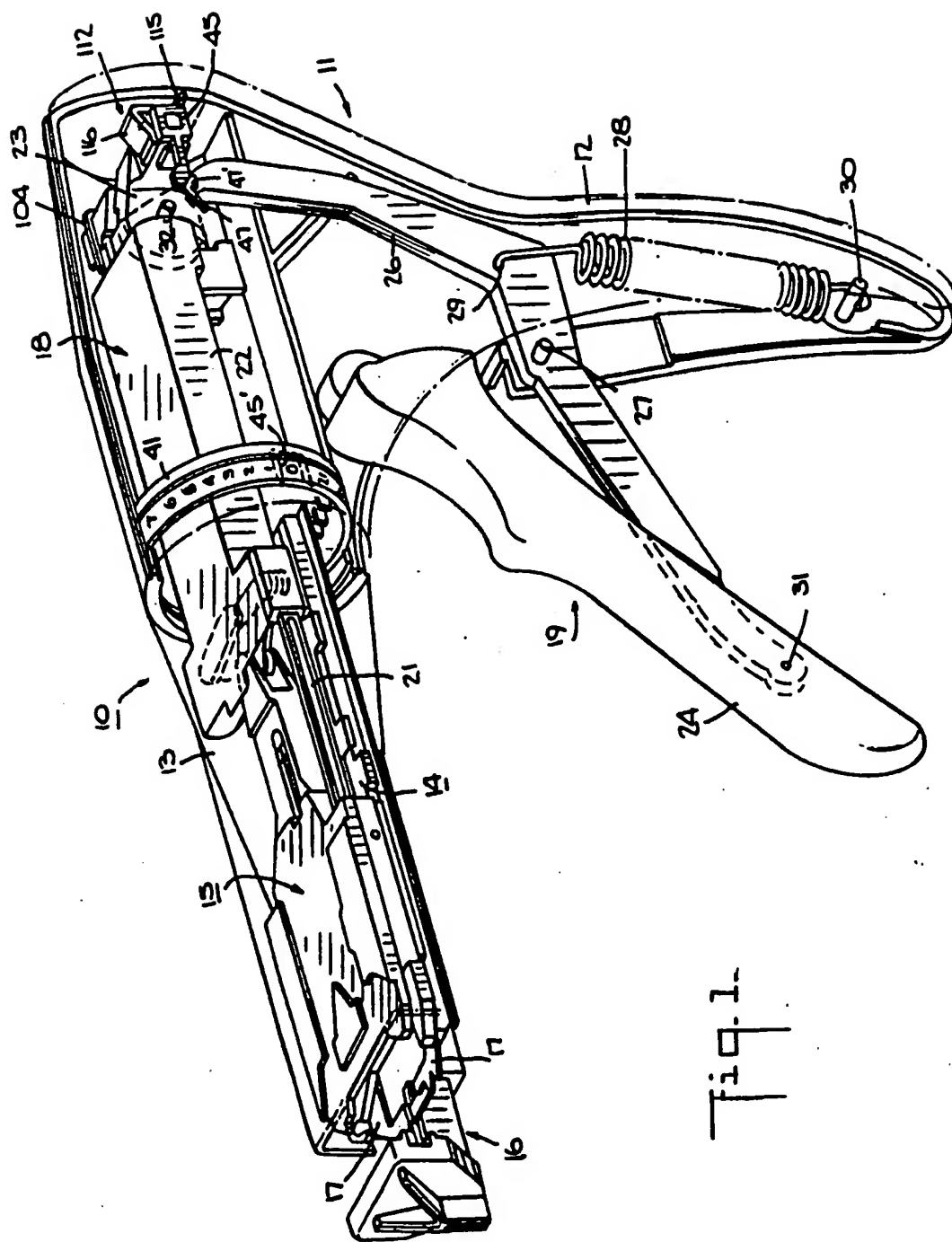
35

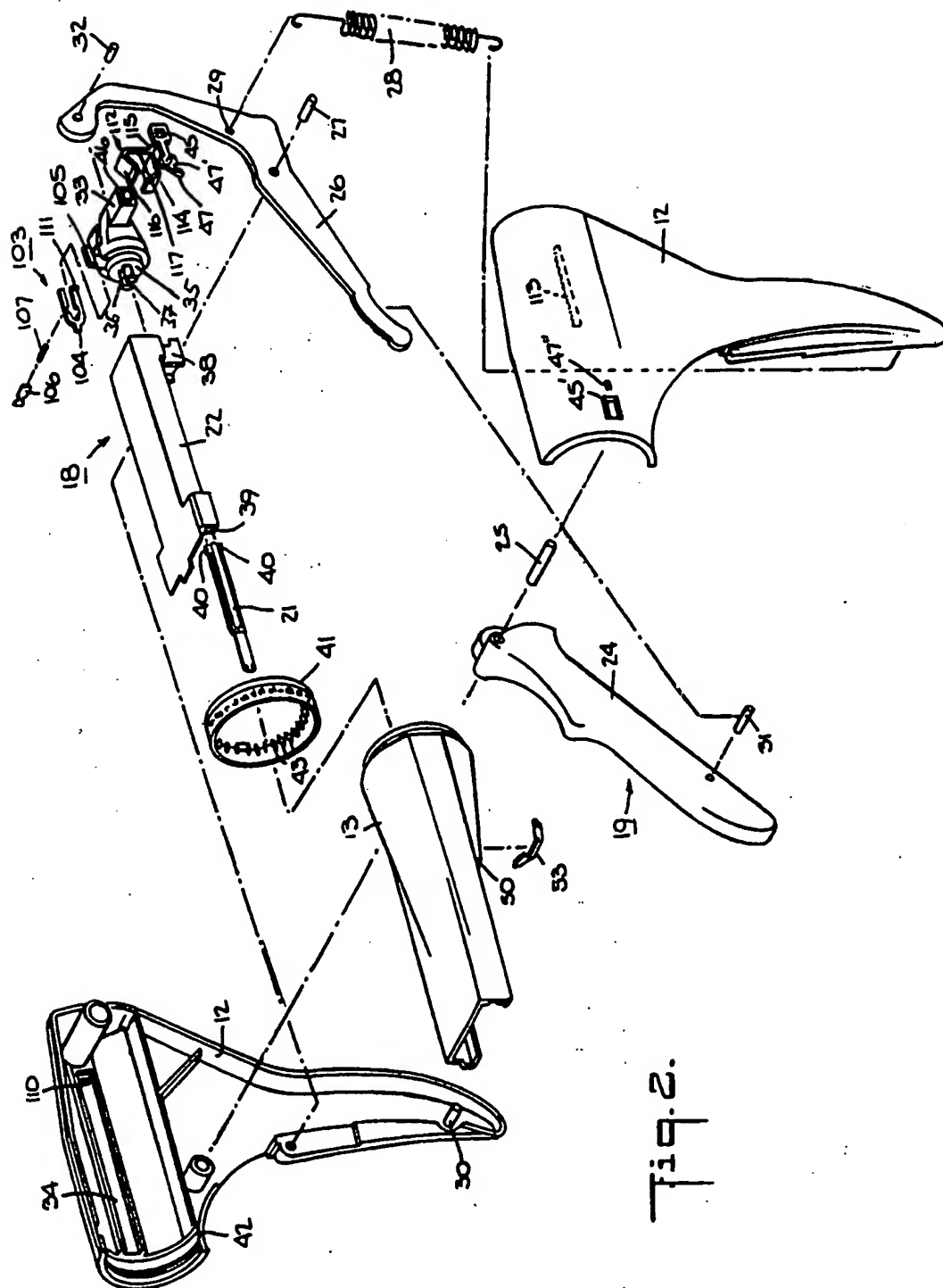
40

45

50

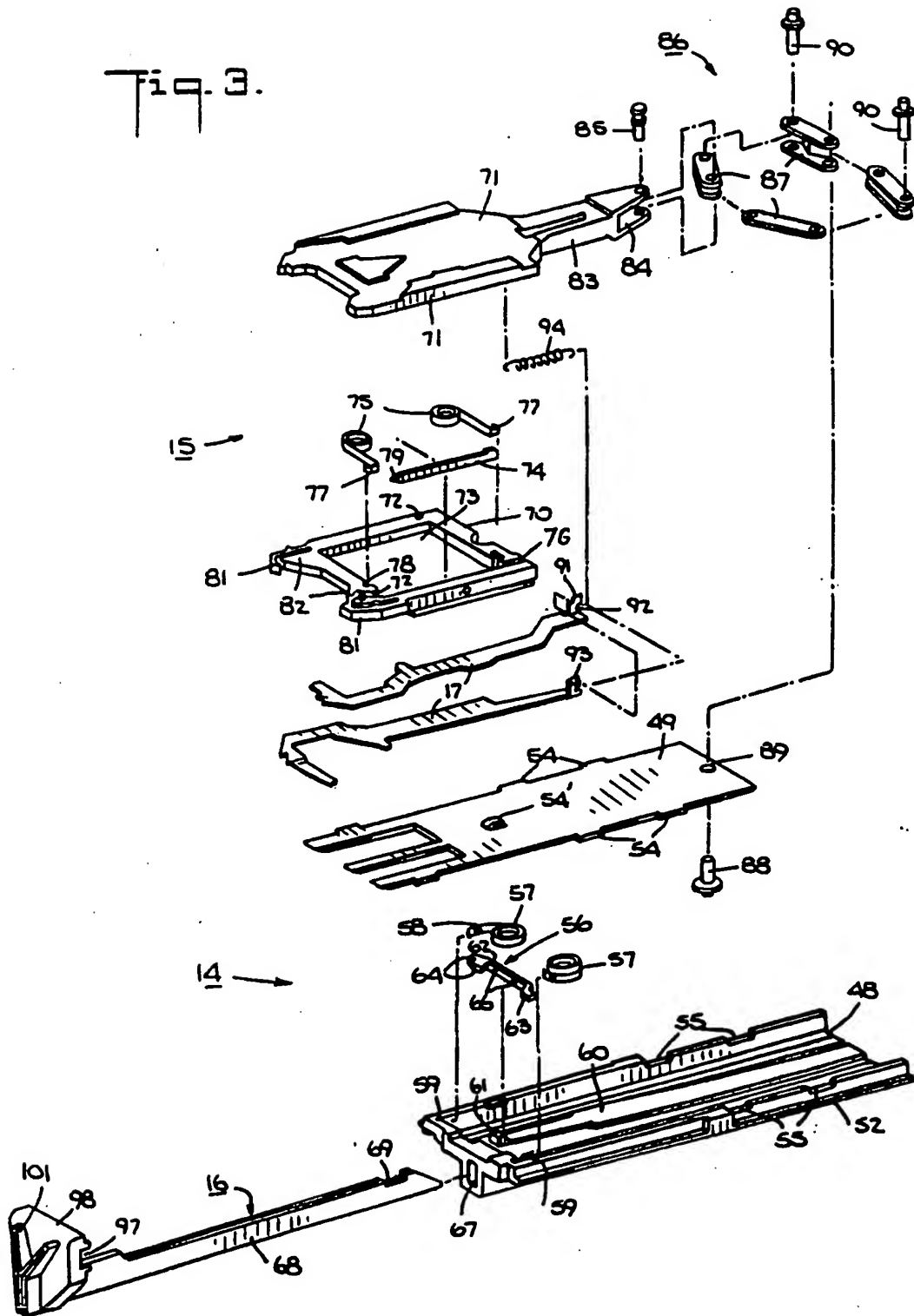
55





निष्कर्ष

Fig. 3.



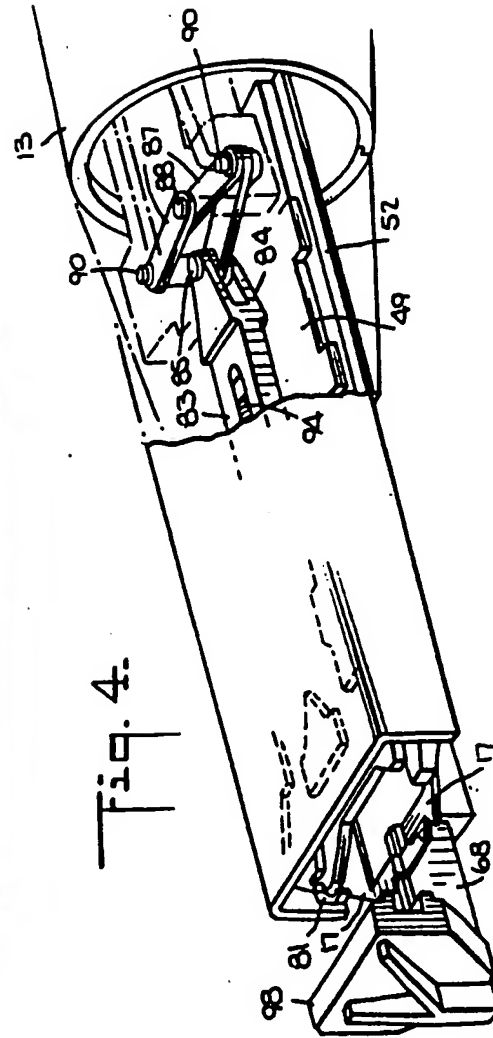
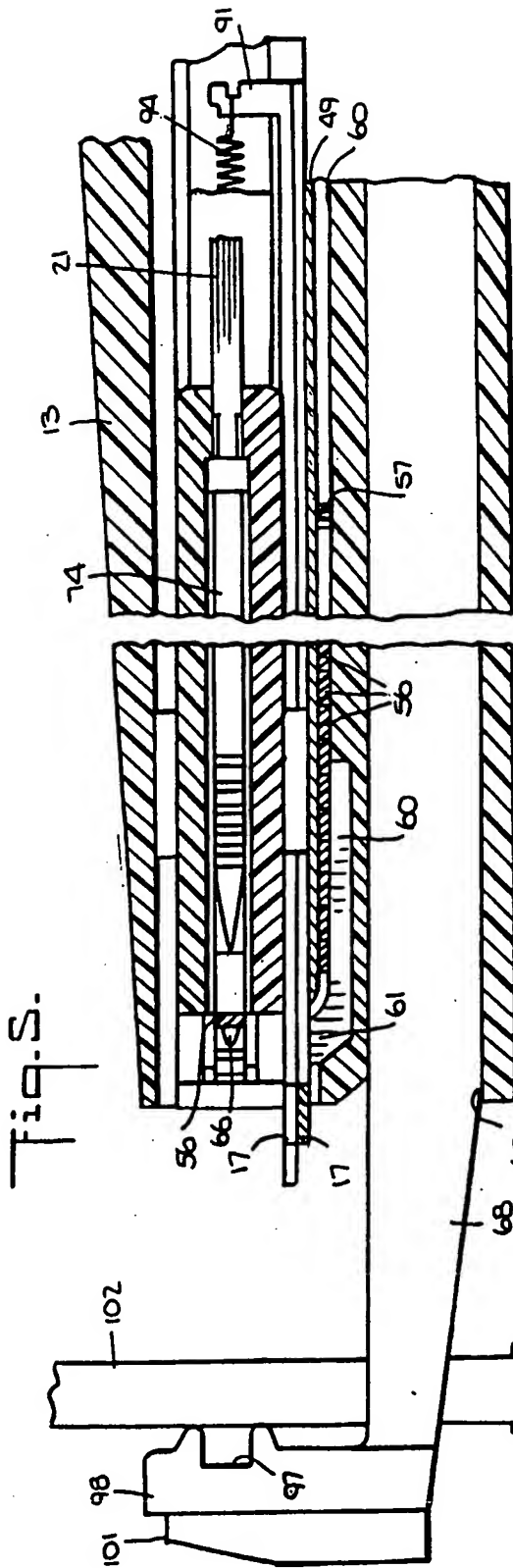
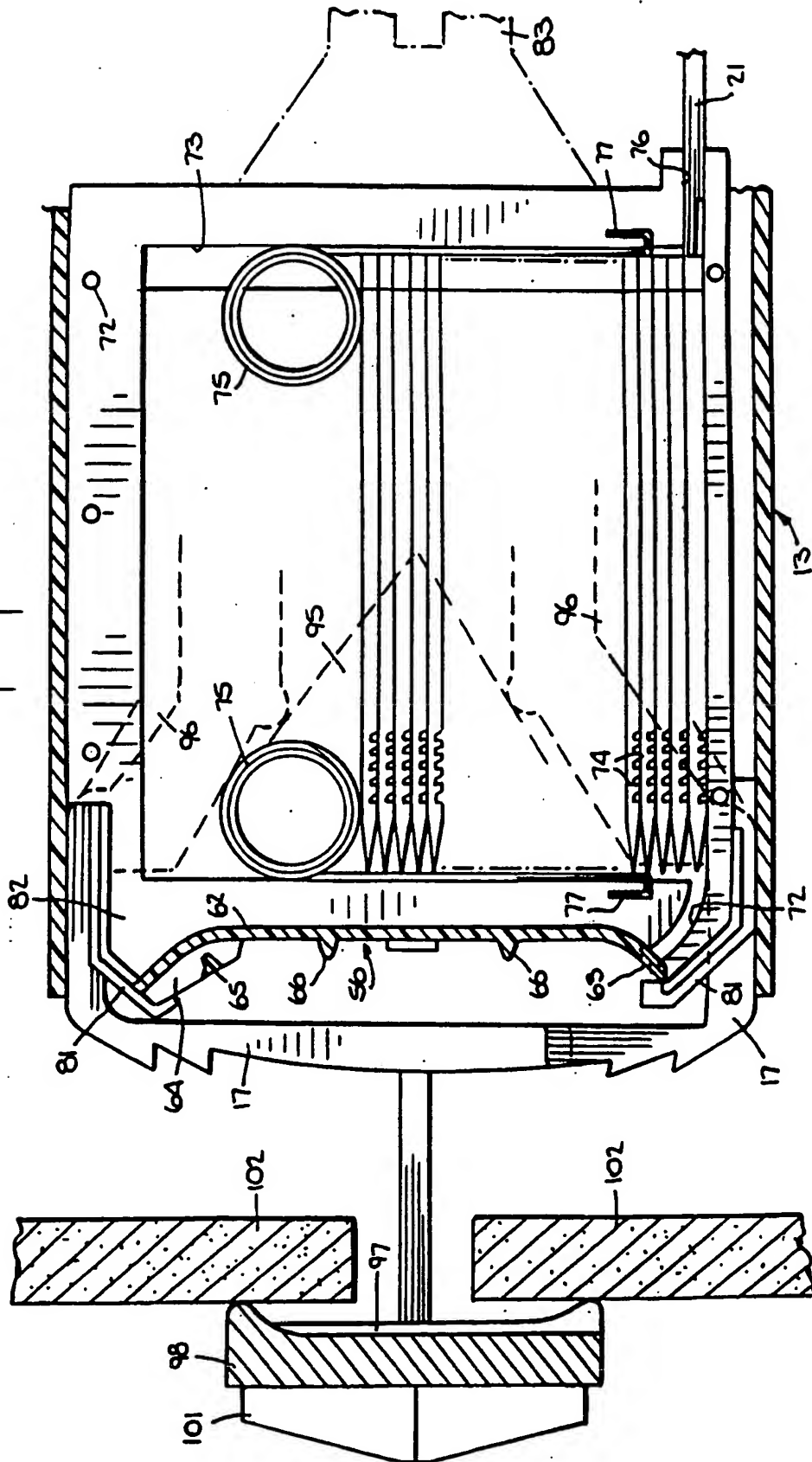


Fig. 6.



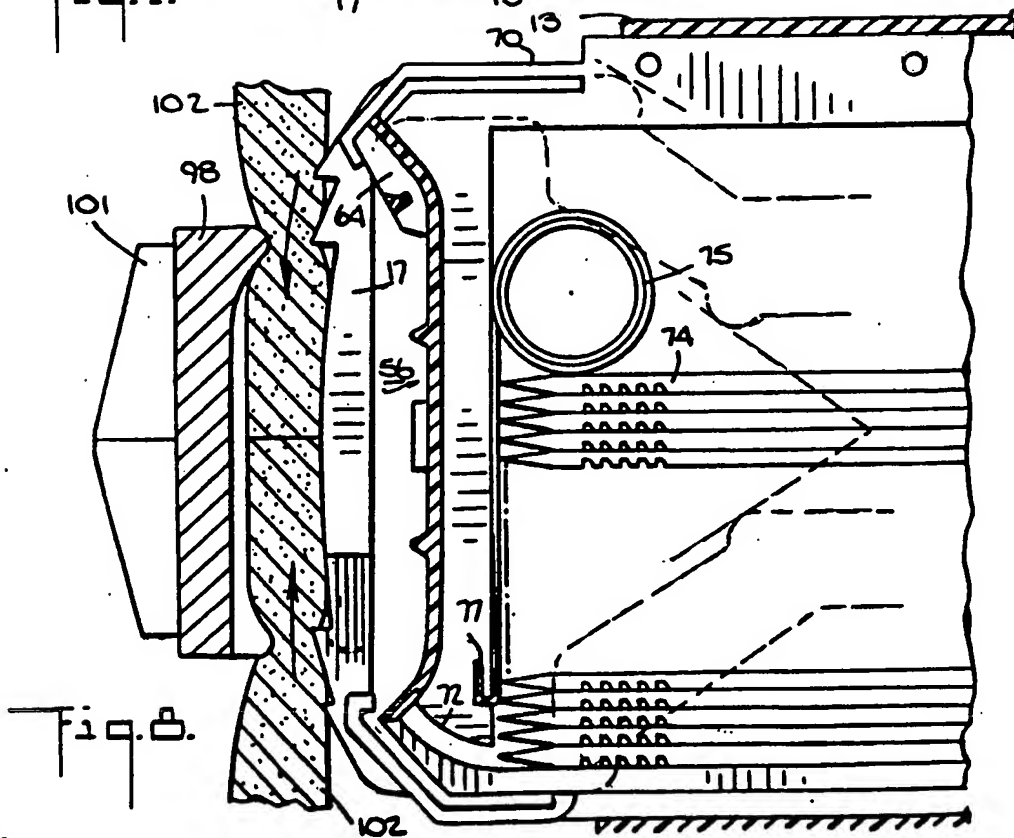
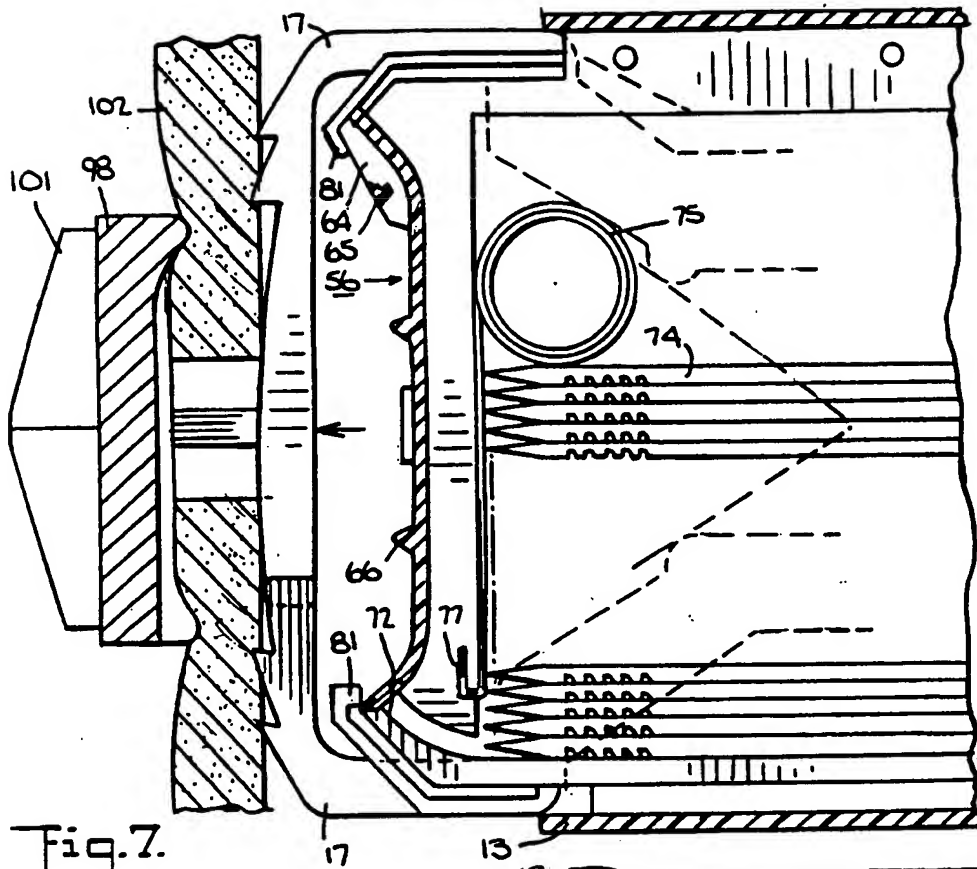


Fig. 9.

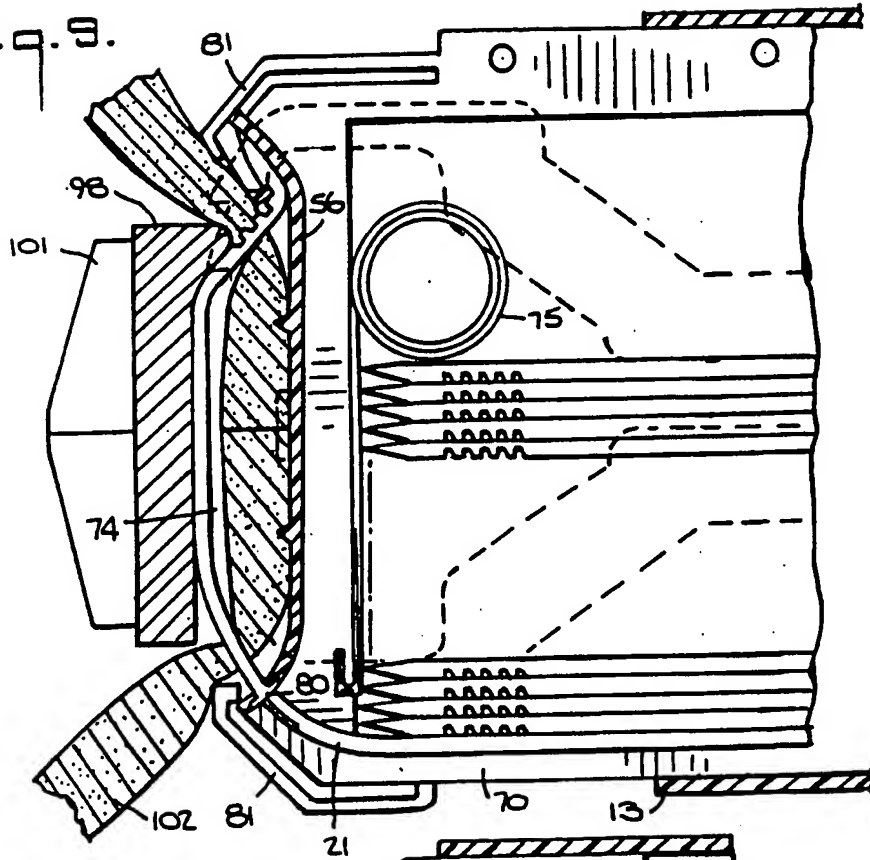


Fig. 10.

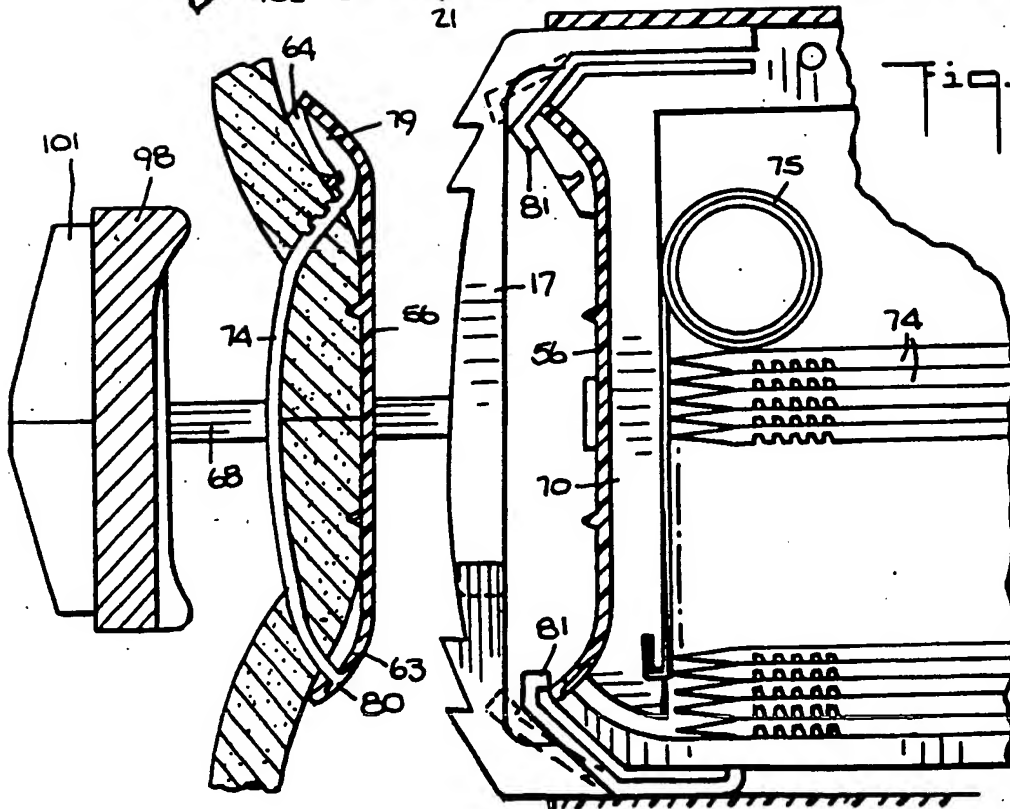


Fig. 11.

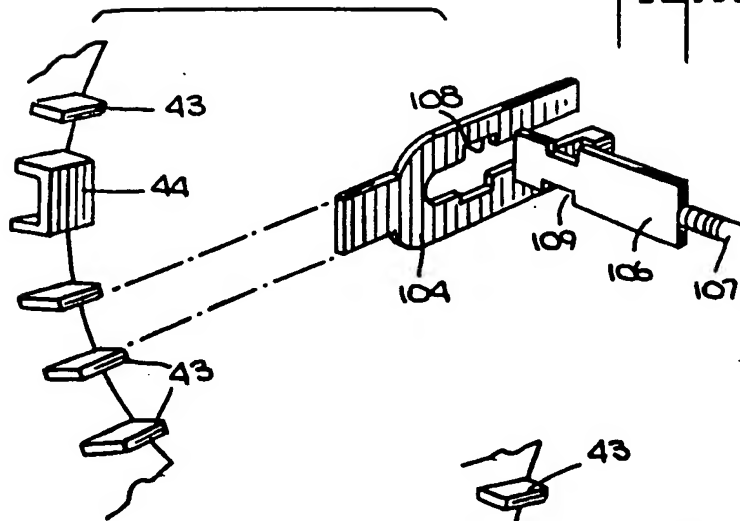


Fig. 12.

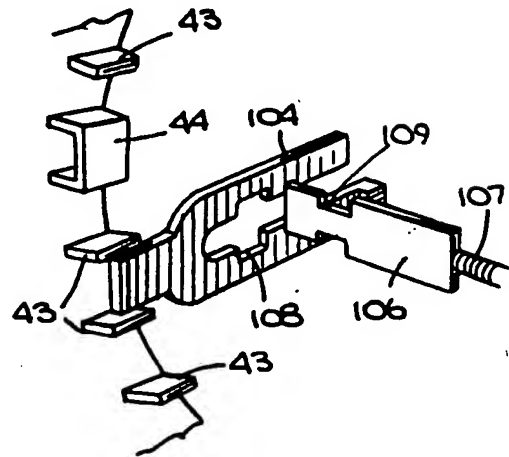


Fig. 13.

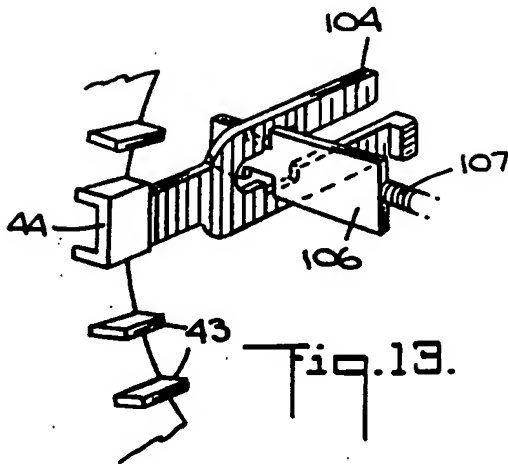


Fig. 14.

